Appendix I

V-3 Overflow Prevention Plan

Document ID: EDF-ER-2647
Revision ID: B
Effective Date: 06/25/01

Engineering Design File

V-3 Liquid Level Contingency Design

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho

INEEL
Idaho National Engineering & Environmental Laboratory
BECHTEL BWXT IDAHO, LLC

Form 412.14
10/05/99
Rev. 02

ENGINEERING DESIGN FILE

Functional File No. _____
EDF No. EDF-ER-2647

1. Project File No.: N/A 2. Project/Task: V-Tank RD/RA

3. Subtask: N/A

4. Title: V-3 Liquid Level Contingency Design

5. Summary:

The liquid level in Tank V-3 at Test Area North has increased since 1996. This design file documents the contingency plan in the event the liquid level in V-3 exceeds a statistically based trigger value. Transferring liquid from V-3 to V-1 will mitigate the threat of V-3 exceeding its 10,000-gallon capacity and releasing contamination to the environment.

6. Distribution (complete package):

Distribution (summary package only):

7. Review (R) and Approval (A) Signatures:

(Minimum reviews and approvals are listed. Additional reviews/approvals may be added.)

	R/A	Typed Name/Organization	Signature	Date
Performer	R	Jacob Harris, Environmental Engineer		
Reviewer	R	Janet Rodriguez, OU 1-10 Lead Engineer		
Requestor	A	Al Jantz, OU 1-10 Program Manager		
Approver	A	Jerry Shea, WAG 1 Project Engineer		

CONTENTS

FIGURES

TABLES

V-3 Liquid Level Contingency Design

1. INTRODUCTION

Tanks V-1, V-2, and V-3 are 10,000-gal stainless steel tanks that have been used to store radioactive liquid wastes generated at Test Area North since the early 1950s. In 1968, a large quantity of oil was discovered in Tank V-2, and it was taken out of service. The oil was removed from Tank V-2 in 1981, and the liquid in the three tanks (V-1, V-2, and V-3) was removed in 1982. The tanks have not been used since the 1980s, although liquids (i.e., rainwater, snowmelt) may have accidentally discharged to Tank V-3 during the 1980s (DOE-ID 1997).

The tanks are 10 ft in diameter and 18 ft long. Buried approximately 10 ft below grade, the tanks have 20-in. manholes that are accessible through 6-ft diameter culverts installed in 1981. In 2000, when rising liquid levels were measured in Tank V-3, a gasket was installed in the manhole to prevent the suspected infiltration of snowmelt and rainwater through the manhole.

2. PROBLEM IDENTIFICATION

Liquid level data of Tank V-3 have been collected since April 29, 1996 (see Attachment 3). The reported 18-ft length includes rounded ends. To calculate the volume from liquid height, a right cylinder lying horizontally, 17.1 ft long and 10 ft in diameter is the geometric shape that was used. This shape has a calculated volume of 10,047 gal. According to liquid level data taken March 29, 2001, Tank V-3 contains an estimated 8,082 gal.

A regression line was fit to the data and a 0.87 correlation coefficient was found thus indicating a good linear fit. The slope of the regression line indicates the tank gains approximately 425 gallons each year (see Figure 3-1).

There are two problems to be solved. First, statistically determine a liquid level value that triggers action. Second, design the actions to be implemented after the trigger value is reached.

3. PROBLEM SOLUTION – LIQUID LEVEL VALUE

To predict tank volume into the future, a regression line and a 99% upper predicted limit (UPL) was applied to the existing data. The forecasted 99% UPL reaches the 10,000-gal capacity of the tank February 9, 2004. Thus, based on existing data, it is 99% certain the tank will not reach its capacity before February 9, 2004 (see Figure 3-2).

The following approach is used to determine what volume level should trigger a transfer of liquid from V-3. The trigger value assumes one year of time to allow for inflow while the action is implemented. The current data indicates the 99% UPL will reach the 10,000-gal level on February 9, 2004, and, thus, one year of time to implement indicates February 9, 2003, is the best prediction of when action must be implemented. Using the predicted value from the linear regression, the best estimate of tank volume on that date will be 8,973 gal (see Attachment 2).

The prediction of tank volume is dependant on the linear regression model of the data. As data are collected in the future, the slope of the linear regression model may change. The change of slope will change the date of reaching the 10,000-gal 99% UPL and thus the trigger value one year prior. Each data point collected should be put into this statistical model to obtain the best real time analysis. After data are input into the model, a graph such as Figure 3-2 should be used to determine the "new" 10,000-gal 99% UPL prediction date. The trigger value will be the predicted value from the linear regression one year prior to the 10,000-gal 99% UPL prediction date.

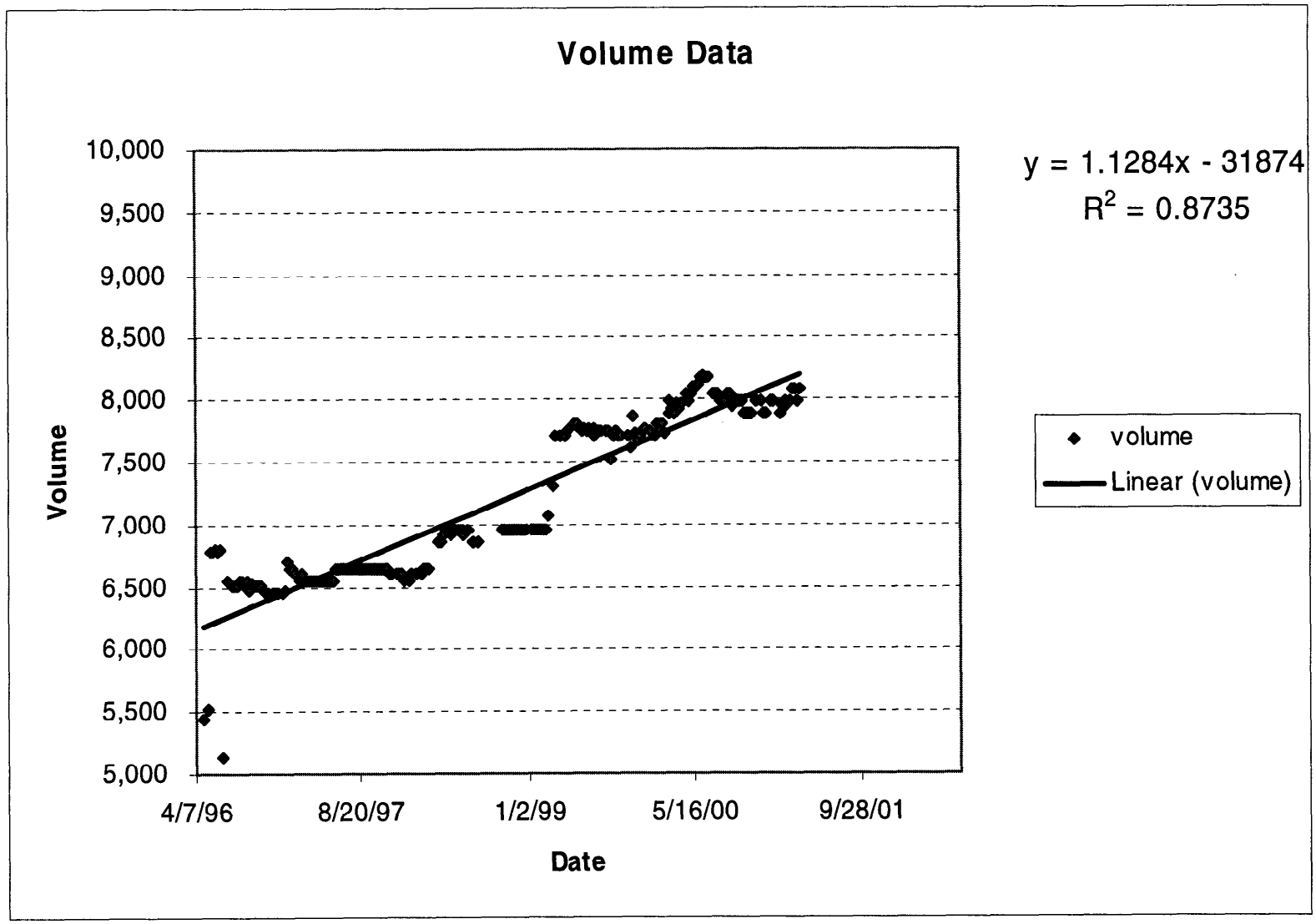


Figure 3-1. Volume data from Tank V-3.

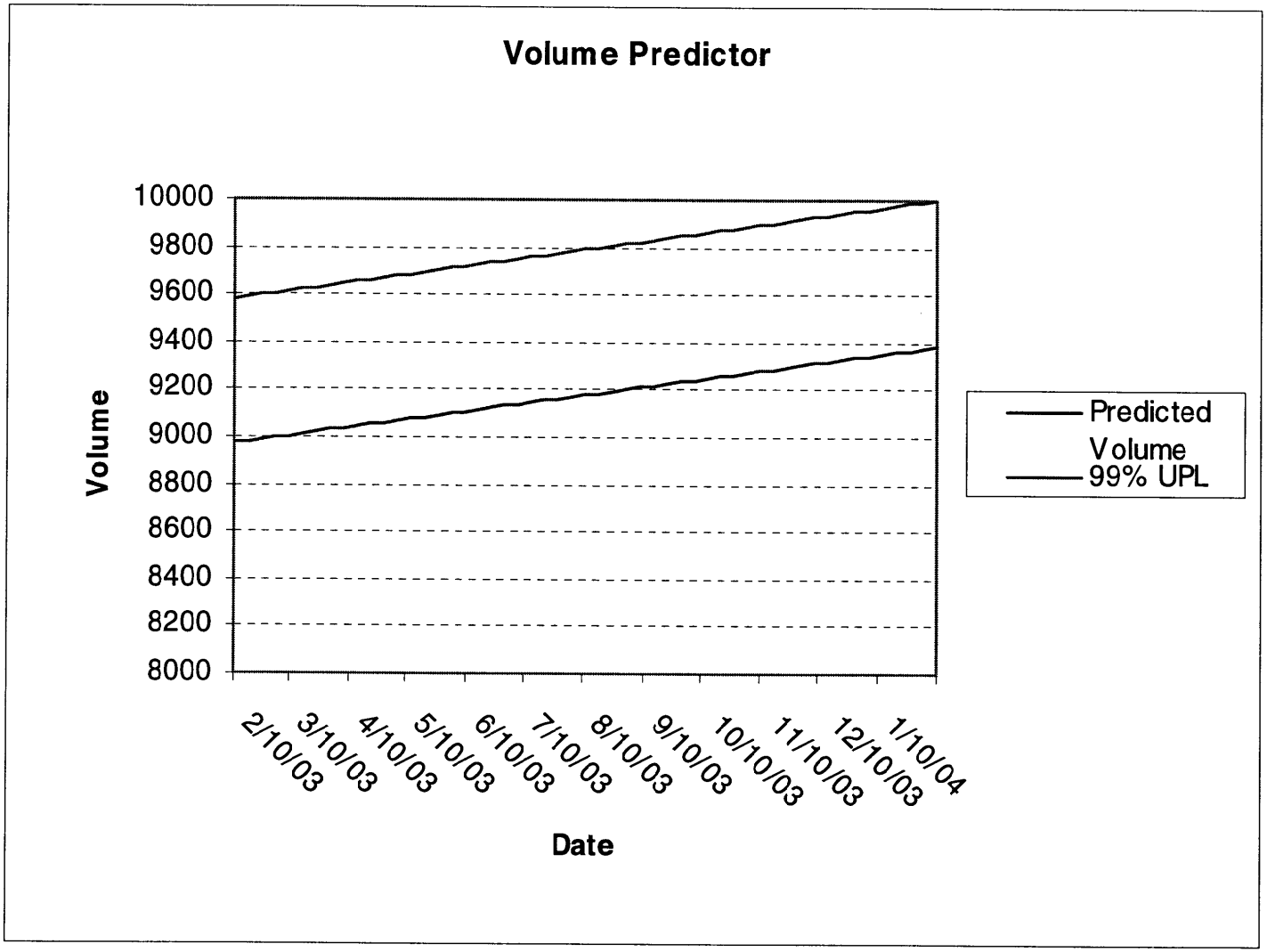


Figure 3-2. Volume predictor with 99% UPL.

4. PROBLEM SOLUTION – ACTIONS TO IMPLEMENT

If the trigger value has been reached and a decision has been made to take corrective action, liquid should be transferred out of V-3. Transferring liquid from V-3 will mitigate the threat of V-3 exceeding its 10,000-gal capacity and releasing contamination to the environment.

Liquid should be pumped from V-3 to a final volume of approximately 7,500 gal, which corresponds to 84 in. of liquid. Based on the current linear regression, 7,500 gal would allow more than 5 years of the 425-gal per year increase. Five years would allow adequate time for the remedial action to permanently address the V-Tank site.

Tank V-1 is the recommended location to store the liquid from V-3. The 1,430-gal level measured in V-1 has been very consistent, it contains the lowest volume of the three tanks. Using a tank instead of waste containers avoids the issue of waste storage location and procurement of waste containers. Tank V-1 will contain a final volume of 2,900 gal when V-3 is pumped from 8,973 gal to 7,500 gal.

4.1 Equipment

The following section describes the equipment necessary to implement this corrective action should it be required. Each item is listed in Table 4-1, and key items are discussed below.

Table 4-1. Equipment required for liquid transfer.

Equipment	Quantity	Model/Type
Flange funnel[a]	2	Fabricated at Central Facilities Area (CFA)
Peristaltic pump[a]	1	Watson-Marlow 704S/R, 8.8 gpm max
Generator[a]	1	240 Volt, 60 Hz, 2.1 Amps or greater
Peristaltic pump tubing[a]	1	Watson-Marlow Marprene #92, 1-in. bore, 60-ft length
Flange gaskets	2	27.5-in. diameter, 6-bolt pattern, RTV Neoprene 1/4 in. from Paramount Supply, Idaho Falls
Cam and groove coupling, Type A-adapter, NPT female	2	1-in. inside diameter
Hose clamp, smooth band worm drive	2	6-in. length
Cam and groove coupling, Type C-coupler, hose shank	2	1-in. inside diameter
Cam and groove cap	2	1-in. inside diameter
Plastic sheeting	1	3- by 3-ft piece
Sleeving for power cord	1	60-ft length
240-volt power cord	1	As required

a. Description and function are given in the following subsections.

4.1.1 Flange Funnel

The flange funnel will draw liquid from the top of the tank to prevent liquid disturbance near the sludge heel. The sludge heel on bottom of Tank V-3 is easily suspended, and mixing solid materials between tanks should be minimized. The length of the flange funnel inlet pipe is fabricated to leave 7,500 gal remaining in the tank. The drain hole in the middle of the flange funnel is designed to return any drips from the cam and groove connection to the tank (see Attachment 1, Figure 1 for flange funnel details).

4.1.2 Peristaltic Pump

The peristaltic pump is specified because it will not contact any liquid waste and will not require internal decontamination. The Watson-Marlow 704S/R pump will take less than 7 hours of pumping time to pump to 7,500 gal (see Attachment 4 for pump details).

4.1.3 Generator

A generator may be required to run the pump if another source of power is not available or practical. The power requirement for the pump is used to determine the power output requirements for the generator. The pump requires 240 volt, 60 Hz, and 2.1 amps. Any generator that meets these requirements can be used (see Attachment 4 for pump details).

4.1.4 Peristaltic Pump Tubing

The specified Watson-Marlow peristaltic pump tubing is designed to be used with the Watson-Marlow peristaltic pump. The Marprene tubing has a wide range of chemical, temperature, and pressure compatibility. The tubing will be continuous from V-3 to V-1 and will not require secondary containment per 40 Code of Federal Regulations 264.193(f).

4.1.5 Miscellaneous Equipment

The miscellaneous equipment required for this action is all commercially available. The American Society for Testing and Materials (ASTM) or MIL specifications are included on the design drawing (see Attachment 1, Figure 1 for miscellaneous equipment details).

4.2 Work Procedure

The steps listed should be used as a starting point for the work control process and to gain an understanding of how the equipment relates to the work steps. The detailed steps to complete this work are as follows:

1. Have funnel flange fabricated and quality inspected at the Central Facilities Area (CFA) (see Attachment 1, Figure 1).

2. Install cam and groove coupling, type C-coupler, hose shank at both ends of the tubing (see Attachment 1, Figure 1).

3. Remove the wooden lid from the V-1 manhole.

4. Unbolt and remove the existing flange cover and gasket.

5. Set the new gasket in place.

6. Set the flange funnel in place, align holes, and bolt securely.

7. Connect the tubing to the cam and groove coupling, type A-adapter on the flange funnel.

8. Remove the wooden lid from the V-3 manhole.

9. Lower the pump down the manhole and place it on top of the 3- by 3-ft plastic sheeting next to the 20-in. flange.

10. Unbolt and remove the existing flange cover and gasket.

11. Set the new gasket in place.

12. Set the flange funnel in place, align holes, and bolt securely.

13. Connect the tubing to the cam and groove coupling, type A-adapter, on the flange funnel.

14. Place the tubing in the peristaltic pump per the manufacturer's instructions.

15. Verify flange funnels and cam and groove connections are securely in place.

16. Verify the tubing is correctly installed in the peristaltic pump.

17. Turn the pump on and set to the maximum flow rate.

18. Inspect the tubing and cam and groove couplings for leaks.

19. Inspect liquid flow into V-1 at 10-minute intervals until the flow stops.

    Note: The pump and the tubing will not be damaged if allowed to run dry.

20. Turn pump off and remove the tubing from the pump.

    Note: Do not disconnect the tubing from the flange funnel.

21. Remove the pump from the V-3 manhole.

22. Wait 2 minutes to allow the tubing to drain into the tanks.

23. Disconnect the cam and groove coupling from the flange funnel in V-1, and connect the cam and groove cap to prevent drips.

24. Using the existing bolts and washers, bolt the existing gasket and flange cover over the flange funnel in V-1.

    Note: The gasket and flange cover will fit over the flange funnel.

25. Lift the tubing 6 ft above ground for 2 minutes to drain any liquid from the tubing into V-3.

26. Disconnect the cam and groove coupling from the flange funnel in V-3, and connect the cam and groove cap to prevent drips.

27. Using the existing bolts and washers, bolt the existing gasket and flange cover over the flange funnel in V-1.

    Note: The gasket and flange cover will fit over the flange funnel.

28. Replace the wooden lid from V-1 and V-3.

29. Place the tubing, personal protective equipment, plastic sheeting, and sleeving from the power cord into the waste container designated by Waste Generator Services.

4.3 Waste Management

The waste generated during this activity will be less than one 55-gal drum. All contamination will be F-001 listed, Rad waste. The concentration of polychlorinated biphenyls in the liquid of V-3 is <50 ppm according to the analytical data, see Table 4-2, and the waste will not be Toxic Substances Control Act-regulated.

The contaminated items that require disposal at this time are as follows:

- 60-ft tubing with cam and groove caps
- Personal protective equipment
- 3- by 3-ft plastic sheeting
- 60-ft sleeving for power cord.

The pump does not contact any liquid waste and the plastic sheeting prevents contact with the soil. The flange funnel and connecting hardware will not be removed and are not a waste until disposed during the final remedial action of the V-Tanks.

Table 4-2. 1996 polychlorinated biphenyl sampling and analysis results for the liquid phase in Tanks V-1, V-2, and V-3.

	Concentration by Sample ID (Tank ID in parentheses) (ug/L)[a]				
Analyte	2CB101014V (V-1)	2CB108014V (V-1)	2CB201014V (V-2)	2CB206014V (V-2)	2CB307018V (V-3)
Aroclor-1016	U (100)[b]	U (100)	U (100)	U (100)	U (100)
Aroclor-1221	U (200)	U (200)	U (200)	U (200)	U (200)
Aroclor-1232	U (100)	U (100)	U (100)	U (100)	U (100)
Aroclor-1242	U (100)	U (100)	U (100)	U (100)	U (100)
Aroclor-1248	U (100)	U (100)	U (100)	U (100)	U (100)
Aroclor-1254	U (100)	U (100)	U (100)	U (100)	U (100)
Aroclor-1260	U (100)	U (100)	U (100)	U (100)	U (100)

a. Analysis performed on liquid portion of samples following gravity filtration; data validation level "C."

b. U - not detected, detection limit given in parentheses.

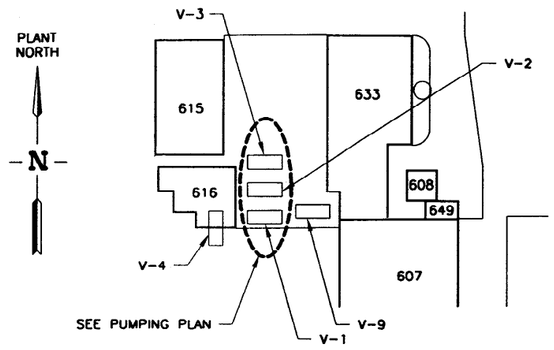
5. REFERENCE

DOE-ID, 1997, *Comprehensive Remedial Investigation/Feasibility Study (RI/FS) for the Test Area North (TAN) Operable Unit (OU) 1-10 at the Idaho National Engineering an Environmental Laboratory*, U.S. Department of Energy Idaho Operations Office, DOE/ID-10557, November.

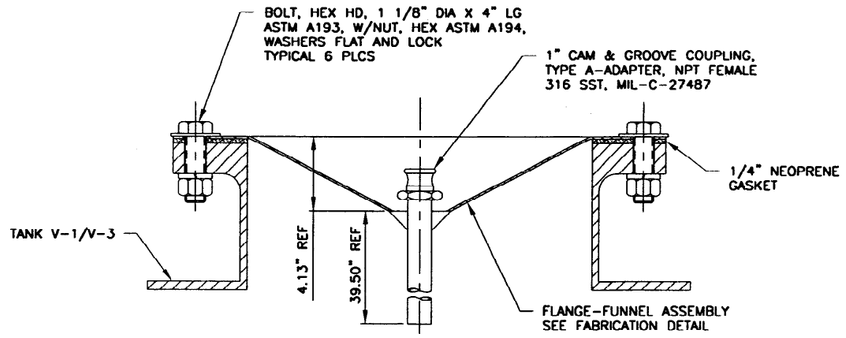
Attachment 1

Figure 1 - Tank V-3 Liquid Level Contingency Design

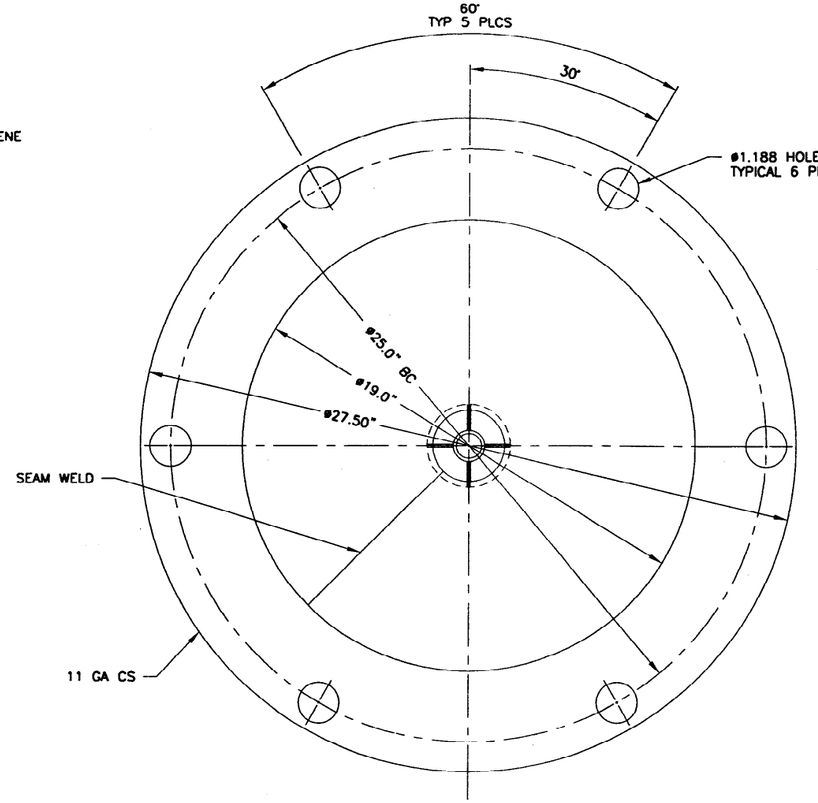
REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:

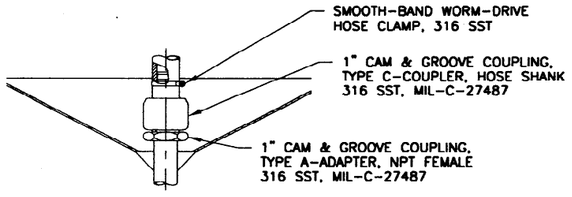


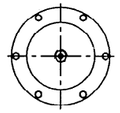
AREA PLAN



ENLARGED VIEW

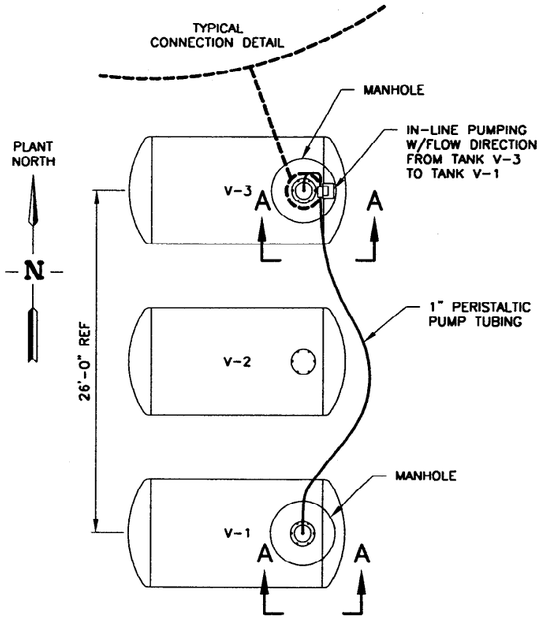




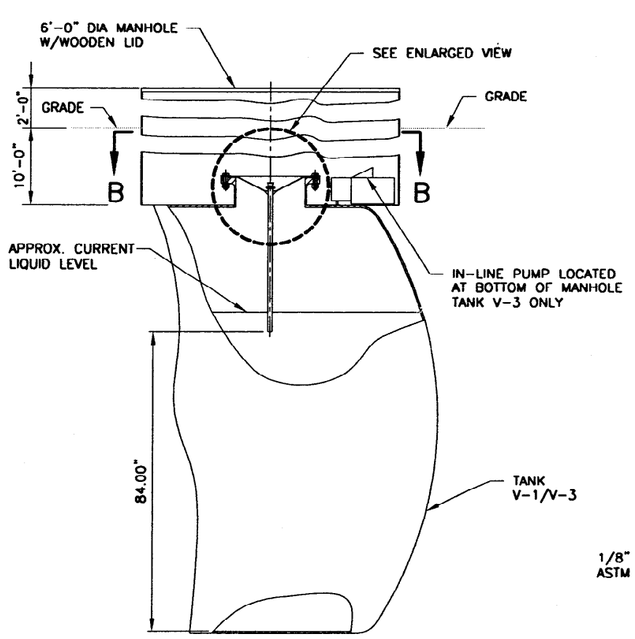


VIEW B-B

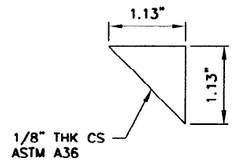
MANHOLE, PUMP & TANK OMITTED FOR CLARITY



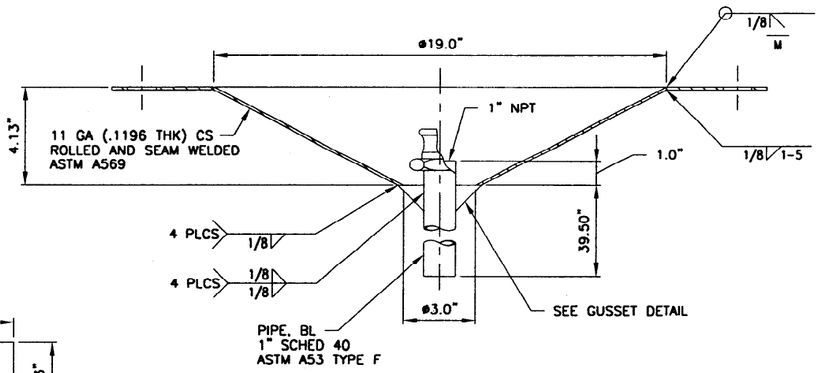
PUMPING PLAN



VIEW A-A



GUSSET DETAIL



FABRICATION DETAIL

SUBCONTRACT NO.	INEEL — Idaho National Engineering & Environmental Laboratory, BECHTEL BWXT IDAHO, LLC
REQUESTER:	INEEL
DESIGN: JAKE HARRIS	TAN V-TANK
DRAWN: ROB HERGESHEIMER	TANK V-3 LIQUID LEVEL CONTINGENCY DESIGN
PROJECT NO.	
SPEC CODE	SIZE: D — CAGE CODE: 01MF3 — INDEX CODE NUMBER: AREA, TYPE, CL, ORIG: 090 — DWG- — REV
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SCALE: NONE — SHEET FIGURE 1
EFFECTIVE DATE:	

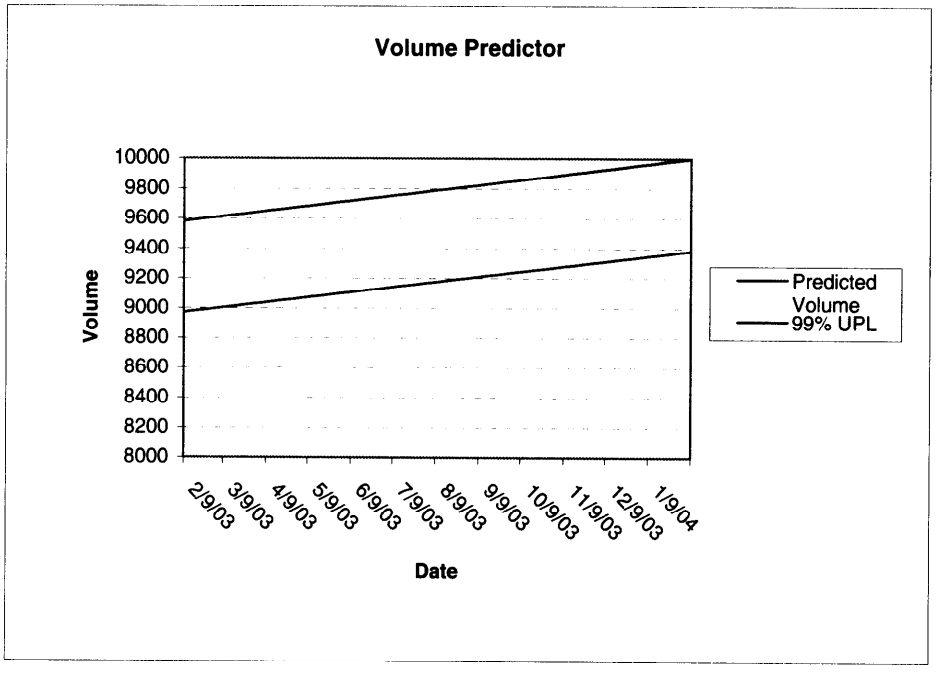
Attachment 2

Statistical Model for V-3 Level Prediction

One Year Prior to 10,000 Gallon 99% UPL
(establishes trigger value)

Starting Date:	2/9/03

Date	Predicted Vol	99% UPL	Date	Predicted Vol	99% UPL
2/9/03	8972	9581	8/17/03	9186	9798
2/16/03	8980	9589	8/24/03	9193	9806
2/23/03	8988	9597	8/31/03	9201	9814
3/2/03	8996	9605	9/7/03	9209	9822
3/9/03	9004	9613	9/14/03	9217	9830
3/16/03	9012	9621	9/21/03	9225	9838
3/23/03	9020	9629	9/28/03	9233	9846
3/30/03	9028	9637	10/5/03	9241	9854
4/6/03	9035	9645	10/12/03	9249	9862
4/13/03	9043	9653	10/19/03	9257	9870
4/20/03	9051	9661	10/26/03	9265	9878
4/27/03	9059	9669	11/2/03	9272	9886
5/4/03	9067	9677	11/9/03	9280	9894
5/11/03	9075	9685	11/16/03	9288	9902
5/18/03	9083	9694	11/23/03	9296	9910
5/25/03	9091	9702	11/30/03	9304	9918
6/1/03	9099	9710	12/7/03	9312	9926
6/8/03	9107	9718	12/14/03	9320	9934
6/15/03	9114	9726	12/21/03	9328	9942
6/22/03	9122	9734	12/28/03	9336	9950
6/29/03	9130	9742	1/4/04	9344	9958
7/6/03	9138	9750	1/11/04	9351	9966
7/13/03	9146	9758	1/18/04	9359	9974
7/20/03	9154	9766	1/25/04	9367	9982
7/27/03	9162	9774	2/1/04	9375	9990
8/3/03	9170	9782	2/8/04	9383	9998
8/10/03	9178	9790	2/15/04	9391	10006



Attachment 3

Spreadsheet – V-3 Volume Data

V-3 Volume Data

Tank Length*	17.1 ft
Tank Radius	5 ft
Tank Capacity**	10,000 gal

***Geometric shape for calculating volume is a right cylinder laying horizontally.**
****Calculated capacity is 10,046 gallons.**

Observation	Measurement Date	Level (Inches)	Level (Feet)	Volume (gallons)
1	4/29/96	64	5.33	5449
2	5/15/96	64.75	5.40	5529
3	5/22/96	76.75	6.40	6785
4	5/30/96	76.75	6.40	6785
5	6/5/96	77	6.42	6811
6	6/12/96	76.75	6.40	6785
7	6/19/96	77	6.42	6811
8	6/27/96	61	5.08	5130
9	7/10/96	74.5	6.21	6554
10	7/17/96	74.25	6.19	6528
11	7/25/96	74	6.17	6502
12	7/31/96	74	6.17	6502
13	8/7/96	74	6.17	6502
14	8/13/96	74.5	6.21	6554
15	8/22/96	74.5	6.21	6554
16	8/28/96	74	6.17	6502
17	8/28/96	74	6.17	6502
18	9/4/96	74.5	6.21	6554
19	9/11/96	74	6.17	6502
20	9/18/96	73.75	6.15	6476
21	9/25/96	74.25	6.19	6528
22	10/2/96	74	6.17	6502
23	10/8/96	74	6.17	6502
24	10/16/96	74	6.17	6502
25	10/23/96	74	6.17	6502
26	10/30/96	73.75	6.15	6476
27	11/7/96	73.5	6.13	6450
28	11/13/96	73.5	6.13	6450
29	11/27/96	73.5	6.13	6450
30	12/4/96	73.5	6.13	6450
31	12/11/96	73.5	6.13	6450
32	12/24/96	73.5	6.13	6450
33	1/2/97	73.75	6.15	6476
34	1/8/97	76	6.33	6708
35	1/15/97	75.5	6.29	6657
36	1/22/97	75.5	6.29	6657
37	1/29/97	75	6.25	6605
38	2/13/97	74.5	6.21	6554
39	2/19/97	75	6.25	6605
40	2/26/97	74.5	6.21	6554
41	3/5/97	74.5	6.21	6554

V-3 Volume Data

Observation	Measurement Date	Level (Inches)	Level (Feet)	Volume (gallons)
42	3/12/97	74.5	6.21	6554
43	3/19/97	74.5	6.21	6554
44	3/27/97	74.5	6.21	6554
45	4/3/97	74.5	6.21	6554
46	4/10/97	74.5	6.21	6554
47	4/16/97	74.5	6.21	6554
48	4/23/97	74.5	6.21	6554
49	4/30/97	74.5	6.21	6554
50	5/8/97	74.5	6.21	6554
51	5/14/97	74.5	6.21	6554
52	5/21/97	74.5	6.21	6554
53	5/28/97	74.5	6.21	6554
54	6/4/97	75.5	6.29	6657
55	6/11/97	75.5	6.29	6657
56	6/18/97	75.5	6.29	6657
57	6/26/97	75.5	6.29	6657
58	7/2/97	75.5	6.29	6657
59	7/9/97	75.5	6.29	6657
60	7/17/97	75.5	6.29	6657
61	7/28/97	75.5	6.29	6657
62	7/30/97	75.5	6.29	6657
63	8/6/97	75.5	6.29	6657
64	8/13/97	75.5	6.29	6657
65	8/21/97	75.5	6.29	6657
66	8/28/97	75.5	6.29	6657
67	9/4/97	75.5	6.29	6657
68	9/10/97	75.5	6.29	6657
69	9/18/97	75.5	6.29	6657
70	9/25/97	75.5	6.29	6657
71	10/1/97	75.5	6.29	6657
72	10/7/97	75.5	6.29	6657
73	10/16/97	75.5	6.29	6657
74	10/22/97	75.5	6.29	6657
75	10/30/97	75.5	6.29	6657
76	11/5/97	75.5	6.29	6657
77	11/12/97	75	6.25	6605
78	11/19/97	75	6.25	6605
79	12/3/97	75	6.25	6605
80	12/10/97	75	6.25	6605
81	12/18/97	75	6.25	6605
82	12/24/97	74.5	6.21	6554
83	1/12/98	74.5	6.21	6554
84	1/15/98	75	6.25	6605
85	1/20/98	75	6.25	6605
86	1/28/98	75	6.25	6605
87	2/4/98	75	6.25	6605
88	2/16/98	75	6.25	6605
89	2/23/98	75.5	6.29	6657

V-3 Volume Data

Observation	Measurement Date	Level (Inches)	Level (Feet)	Volume (gallons)
90	3/4/98	75.5	6.29	6657
91	3/12/98	75.5	6.29	6657
92	4/6/98	77.5	6.46	6862
93	4/7/98	77.5	6.46	6862
94	4/15/98	77.5	6.46	6862
95	4/21/98	78	6.50	6913
96	4/29/98	78.5	6.54	6964
97	5/5/98	78.5	6.54	6964
98	5/13/98	78	6.50	6913
99	5/19/98	78.5	6.54	6964
100	5/26/98	78.5	6.54	6964
101	6/3/98	78.5	6.54	6964
102	6/10/98	78.5	6.54	6964
103	6/16/98	78.5	6.54	6964
104	6/22/98	78	6.50	6913
105	7/2/98	78.5	6.54	6964
106	7/22/98	77.5	6.46	6862
107	7/30/98	77.5	6.46	6862
108	8/5/98	77.5	6.46	6862
109	10/15/98	78.5	6.54	6964
110	10/20/98	78.5	6.54	6964
111	10/29/98	78.5	6.54	6964
112	11/4/98	78.5	6.54	6964
113	11/10/98	78.5	6.54	6964
114	11/18/98	78.5	6.54	6964
115	11/25/98	78.5	6.54	6964
116	12/1/98	78.5	6.54	6964
117	12/8/98	78.5	6.54	6964
118	12/16/99	78.5	6.54	6964
119	12/23/98	78.5	6.54	6964
120	1/7/99	78.5	6.54	6964
121	1/14/99	78.5	6.54	6964
122	1/25/99	78.5	6.54	6964
123	2/4/99	78.5	6.54	6964
124	2/11/99	78.5	6.54	6964
125	2/16/99	78.5	6.54	6964
126	2/25/99	78.5	6.54	6964
127	3/4/99	79.5	6.63	7065
128	3/17/99	82	6.83	7315
129	3/24/99	86	7.17	7705
130	4/7/99	86	7.17	7705
131	4/19/99	86	7.17	7705
132	4/20/99	86	7.17	7705
133	4/27/99	86.5	7.21	7753
134	5/6/99	86.75	7.23	7777
135	5/20/99	87	7.25	7801
136	5/26/99	87	7.25	7801
137	6/3/99	86.75	7.23	7777

V-3 Volume Data

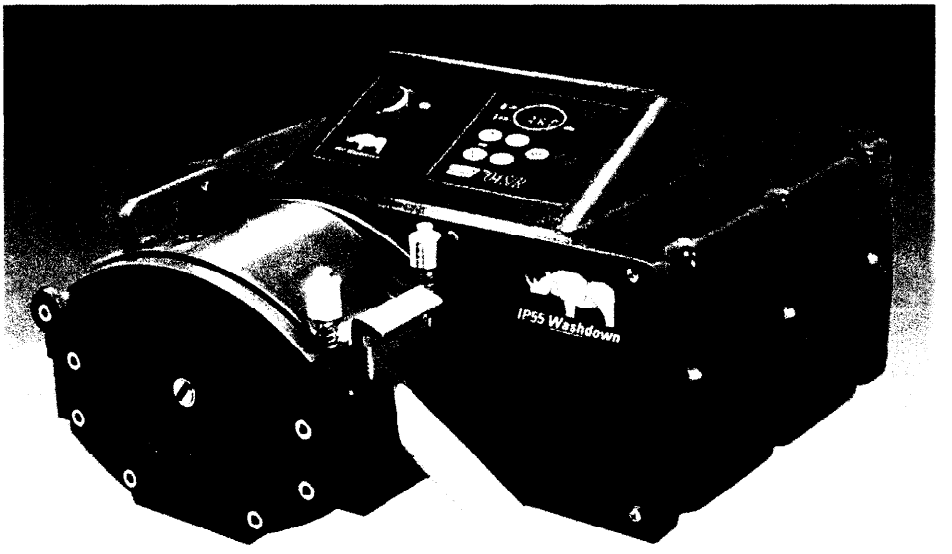
Observation	Measurement Date	Level (Inches)	Level (Feet)	Volume (gallons)
138	6/9/99	86.5	7.21	7753
139	6/17/99	86.75	7.23	7777
140	6/24/99	86.5	7.21	7753
141	7/1/99	86.75	7.23	7777
142	7/8/99	86.5	7.21	7753
143	7/15/99	86	7.17	7705
144	7/21/99	86.75	7.23	7777
145	7/28/99	86.5	7.21	7753
146	8/4/99	86.5	7.21	7753
147	8/11/99	86.5	7.21	7753
148	8/25/99	86.5	7.21	7753
149	8/31/99	86.5	7.21	7753
150	9/4/99	84	7.00	7512
151	9/13/99	86	7.17	7705
152	9/21/99	86.5	7.21	7753
153	9/30/99	86	7.17	7705
154	10/4/99	86	7.17	7705
155	10/26/99	86	7.17	7705
156	11/3/99	85	7.08	7609
157	11/10/99	87.75	7.31	7872
158	11/17/99	86.25	7.19	7729
159	11/24/99	86	7.17	7705
160	11/29/99	85.75	7.15	7681
161	12/6/99	86	7.17	7705
162	12/13/99	86.5	7.21	7753
163	12/21/99	86.75	7.23	7777
164	1/4/00	86.5	7.21	7753
165	1/17/00	86	7.17	7705
166	1/24/00	87	7.25	7801
167	2/2/00	86.5	7.21	7753
168	2/8/00	87	7.25	7801
169	2/15/00	86.25	7.19	7729
170	2/28/00	88	7.33	7896
171	3/2/00	89	7.42	7990
172	3/7/00	88.25	7.35	7919
173	3/16/00	88	7.33	7896
174	3/22/00	88.75	7.40	7966
175	3/29/00	88.25	7.35	7919
176	4/3/00	88.75	7.40	7966
177	4/19/00	89.5	7.46	8036
178	4/29/00	89	7.42	7990
179	5/4/00	89.5	7.46	8036
180	5/11/00	90.25	7.52	8105
181	5/17/00	90.25	7.52	8105
182	5/24/00	90.5	7.54	8128
183	6/1/00	91	7.58	8174
184	6/8/00	91.25	7.60	8197
185	6/15/00	91	7.58	8174

V-3 Volume Data

Observation	Measurement Date	Level (Inches)	Level (Feet)	Volume (gallons)
186	6/27/00	91	7.58	8174
187	7/13/00	89.5	7.46	8036
188	7/20/00	89.5	7.46	8036
189	7/25/00	89.5	7.46	8036
190	8/3/00	89	7.42	7990
191	8/10/00	89	7.42	7990
192	8/16/00	89	7.42	7990
193	8/23/00	89.5	7.46	8036
194	8/31/00	89.5	7.46	8036
195	9/6/00	88.5	7.38	7943
196	9/12/00	89.25	7.44	8013
197	9/20/00	89	7.42	7990
198	9/27/00	89	7.42	7990
199	10/4/00	89	7.42	7990
200	10/13/00	88	7.33	7896
201	10/19/00	88	7.33	7896
202	10/26/00	88	7.33	7896
203	11/1/00	88	7.33	7896
204	11/7/00	88	7.33	7896
205	11/16/00	89	7.42	7990
206	11/22/00	89	7.42	7990
207	11/30/00	89	7.42	7990
208	12/5/00	89	7.42	7990
209	12/14/00	88	7.33	7896
210	1/20/00	88	7.33	7896
211	1/2/01	89	7.42	7990
212	1/12/01	89	7.42	7990
213	1/30/01	88	7.33	7896
214	2/6/01	88.5	7.38	7943
215	2/13/01	88.5	7.38	7943
216	2/13/01	89	7.42	7990
217	2/28/01	89	7.42	7990
218	3/8/01	90	7.50	8082
219	3/14/01	90	7.50	8082
220	3/22/01	89	7.42	7990
221	3/29/01	90	7.50	8082

Attachment 4

Watson-Marlow 704 S/R Pump Engineering and Technical Data



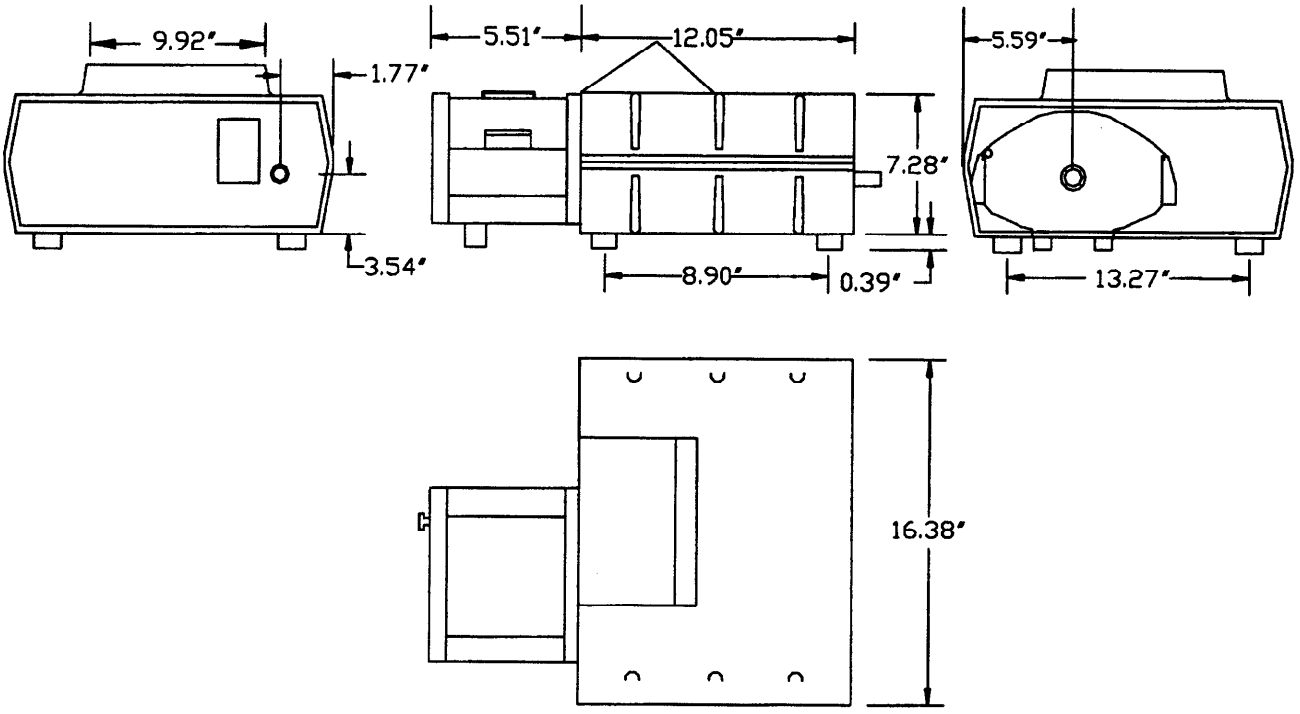
704S/R

Technical Information and Features

- *Flow rates from 0.03 - 8.8 GPM (8.4 to 2000 L/hr)*
- *PWM, microprocessor controlled closed loop speed regulation*
- *Manual control of stop/start, speed, direction, and priming via membrane keypad*
- *LED display of pumphead speed*
- *"Auto Restart", and "Keypad Lock" functions*
- *IP55 washdown enclosure*
- *Fitted with 701R driven roller pumphead*
- *Accepts tube sizes #190, 88, 189, 191, 92 (3/8"-1" bore and 3/16" wall)*
- *Equipped with magnet safety interlock switch to disable pump drive while pumphead is open*

Flow rate ranges (ml/min)

Tube number	#190	#88	#189	#191	#92
Tube bore	9.6mm 3/8"	12.7mm 1/2"	15.9mm 5/8"	19.0mm 3/4"	25.4mm 1"
Speed Range:	7.2-360rpm				
Liter/hr	8.4 - 420	15.6 - 780	22 - 1080	30 - 1500	40 -2000
US gpm	0.03 - 1.9	0.07 - 3.4	0.10 - 4.8	0.13 - 6.6	0.18 - 8.8



704S/R

Specifications

Shipping Weight: 77lbs
Maximum Power Consumption: 505VA
Supply: 100-120/220-240V 50/60Hz
Maximum Rotor Speeds: 360rpm
Enclosure: IP55
Operational Temperature Range: 0C to 40C
Control Range: 50:1
Noise: <78dBA at 1 meter
Standards: In Conformity with CE
Machinery Directive 89/392/EEC, EN60204-1
Low Voltage Directive 73/23/EEC, EN61010-1
EMC Directive 89/336/EEC, EN50081-1/EN50082-1
Product Code: 070.8201.000

Materials of Construction

Track: Epoxy coated aluminum
Rotor: Aluminum, Nylatron rollers
Drive: Epoxy coated pressure cast aluminum
Hardware: 316 Stainless Steel

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